OIL PRODUCTION IN WEST VIRGINIA BY WATERFLOODING, 1959

(In Three Parts)

2. Maxton Sand, Burton Field, Wetzel County

By Charles E. Whieldon, Jr.

* * * * * * * * * * * * information circular 7982

Generated on 2024-09-22 02:44 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

This publication has been cataloged as follows:

Whieldon, Charles E

Survey of oil production in West Virginia by waterflooding, 1959. (In three parts) By Charles E. Whieldon, Jr., and Robert M. Meddles. [Washington] U.S. Dept. of the Interior, Bureau of Mines [1961]

v. illus., maps, tables. 26 cm. (U.S. Bureau of Mines. Information circular 7972, 7982,

Bibliographical footnotes.

Contents. - 1. Cow Run sand, St. Marys field, Pleasants County. - 2. Maxton sand, Burton field, Wetzel County.

1. Oil field flooding - West Virginia. I. Meddles, Robert M joint author. II. Title. (Series)

TN23.U71 622.06173

U.S. Dept. of the Int. Library

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington 25 D.C. - Price 20 cents

Generated on 2024-09-22 02:44 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

PREFACE

This report is the second of a three-part series describing secondary recovery of oil by waterflooding in various counties of West Virginia.

Recovery of oil by waterflooding was legalized by the State legislature in 1953. By January 1957 waterflooding had been started in eight counties. A separate Information Circular will be prepared by the Federal Bureau of Mines on each waterflooding project studied.

In each report the introduction will summarize the results obtained by waterflooding. The discussion will present information on oil-production history and general geology of the county, specific lease production history, waterflood development, lease geology, producing-sand characteristics, source and treatment of water, and a summary of operations on the waterflooding projects studied.

Generated on 2024-09-22 02:47 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CONTENTS

	Page
Preface	iii
Introduction and summary	1
Acknowledgments	4
General geology of Wetzel County	4
History of oil and gas production in Wetzel County	4
History and reserves of the Burton oil pool	6
Discussion of Santee waterflooding project	6
Lease geology	6
History and development	6
Drilling and completion practices	7
Producing-sand characteristics	12
Source and treatment of water	12
Summary of operations	13

ILLUSTRATIONS

Fig.		
1.	Map of West Virginia showing counties for which waterflooding reports have been published by the Bureau of Mines	2
2.	Wetzel County, W. Va., map showing general extent of Burton oilfield, location of major producing formations, and other historical and geological points of interest	3
3.	Generalized geological column showing subsurface stratigraphy of Wetzel County	7
4.	Map showing location and status of wells and leases, Barron Kidd Oil Co., Burton field, Santee project, Church district, Wetzel County, W. Va., January 1959	8
5.	Structure contour map showing top of Maxton sand, Barron Kidd Oil Co., Santee project, Wetzel County, W. Va	9
6.	Isopachous map showing thickness of Maxton sand, Barron Kidd Oil Co., Santee project, Wetzel County, W. Va	10
7.	Graphic-line production history of Barron Kidd Oil Co., Santee project, Wetzel County, W. Va., January 1959	11
8.	Results of core analysis, Santee Heirs well 14, Barron Kidd Oil Co., Santee project, Wetzel County, W. Va	13

TABLE

1.	Summary of operations	14

Generated on 2024-09-22 02:46 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

SURVEY OF OIL PRODUCTION IN WEST VIRGINIA BY WATERFLOODING, 1959
(In Three Parts)

2. Maxton Sand, Burton Field, Wetzel County[1]

by

Charles E. Whieldon, Jr.[2]

INTRODUCTION AND SUMMARY

The importance of producing more oil from known petroleum reserves has placed increased emphasis on the application of secondary-recovery methods.

Recently published reports[3] [4] describe the results of waterflooding in Roane and Pleasants Counties, W. Va. (See fig. 1.)

This report describes the Barron Kidd Oil Co.'s Santee waterflood project, Maxton sand, Burton field, Church district, Wetzel County, W. Va. (See fig. 2.)

The Federal Bureau of Mines hopes that these reports will stimulate interest in improved waterflooding techniques, thereby discouraging premature abandonment of oil leases.

The first oil well was drilled in what is now the Santee waterflood project during 1902. Oil-production data, available from 1913 through 1958, reveal that approximately 304,000 barrels of oil were produced from 38 oil wells at an average depth of 2,300 feet.

Gas injection was begun in 1953 but was replaced in 1955 by a pilot waterflood operation. Oil production in 1952 totaled 3,715 barrels; and by 1958, after 5 years of secondary-recovery operations, yearly oil production had increased to 6,633 barrels. An estimated 22 million cubic feet of gas and

---

1/ Work on manuscript completed March 1960.
2/ Engineering aid (petroleum), Bureau of Mines, Morgantown, W. Va.
3/ Nabors, W. M., Caspero, N. A., Pasini, J., III, and Whieldon, C. E., Jr., Secondary Recovery of Oil by Waterflooding in the Big Injun Sand, Roane County, W. Va.: Bureau of Mines Rept. of Investigations 5601, 1960.
4/ Whieldon, Charles E., Jr., and Meddles, Robert M., Survey of Oil Production in West Virginia by Waterflooding, 1959, (In Three Parts), Part I. Cow Run Sand, St. Marys Field, Pleasants County: Bureau of Mines Inf. Circ. 7972, 14 pp.

Generated on 2024-09-22 02:52 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

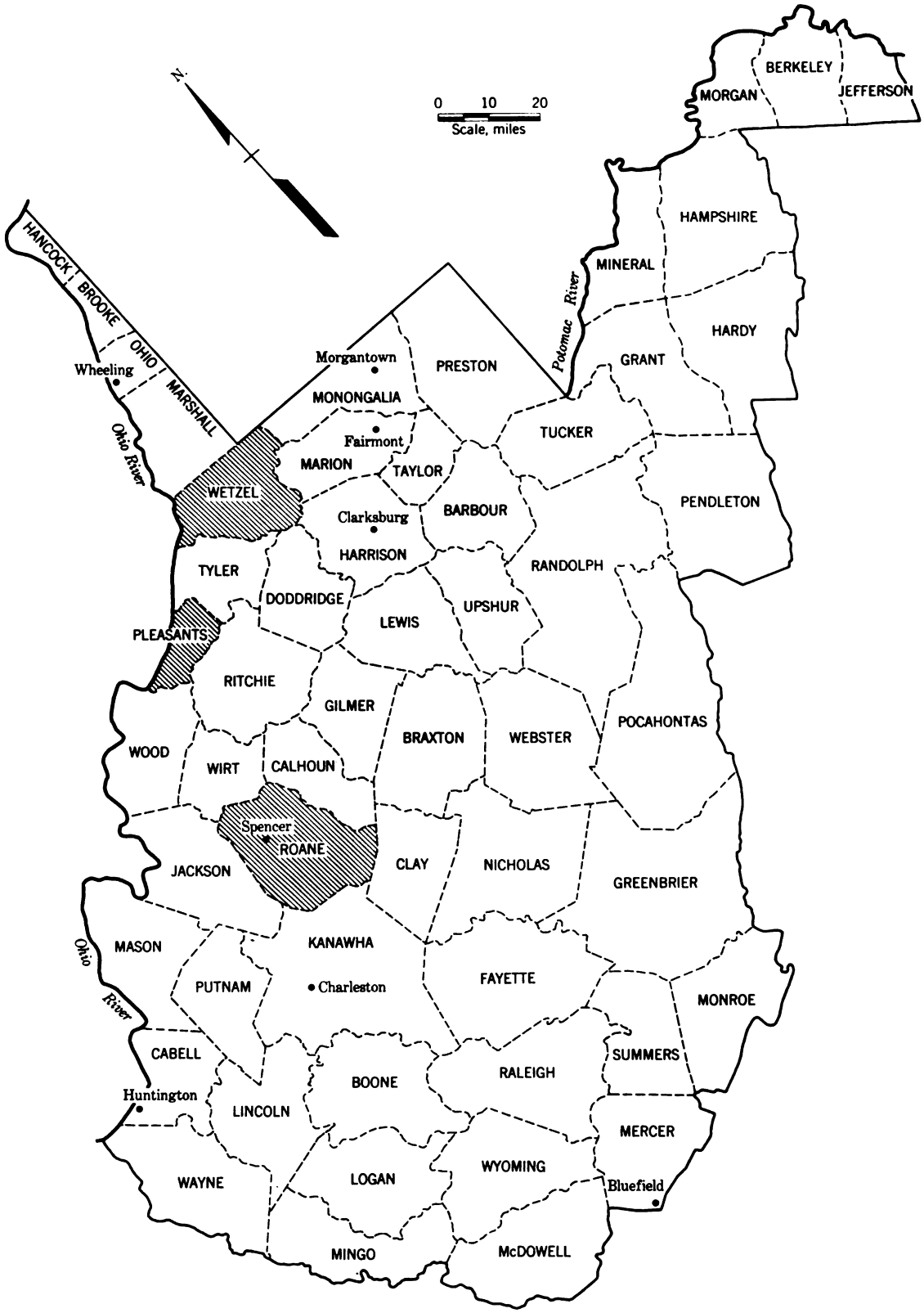

FIGURE 1. - Map of West Virginia Showing Counties for Which Waterflooding Reports Have Been Published by the Bureau of Mines.

Generated on 2024-09-22 02:44 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-22 02:48 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

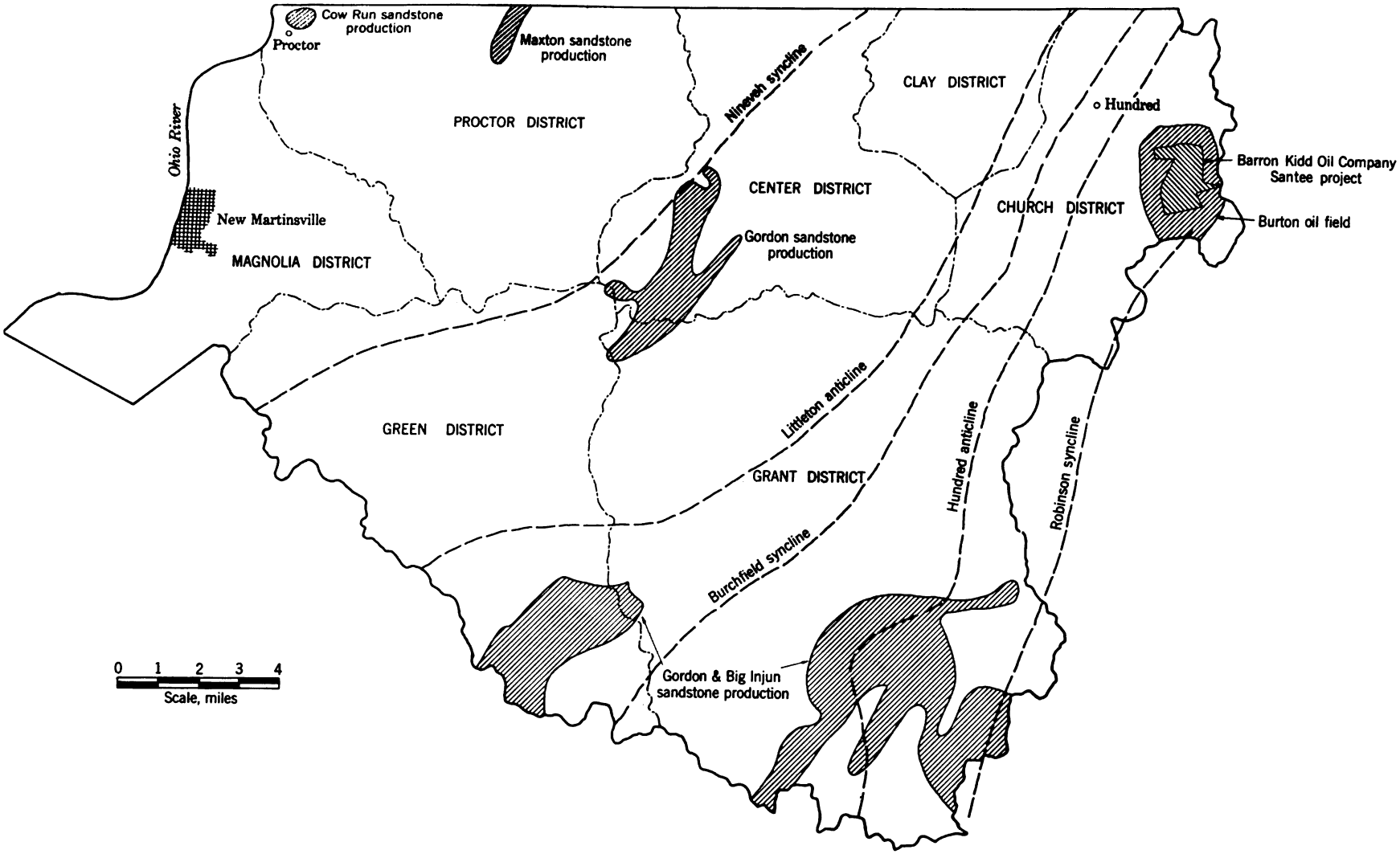

FIGURE 2. - Wetzel County, W. Va., Map Showing General Extent of Burton Oilfield, Location of Major Producing Formations, and Other Historical and Geological Points of Interest.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

240,000 barrels of water were injected into the reservoir during this 5-year period.

The first increase in oil production resulting from waterflooding was detected after 35 months of water injection. A 27-month delay in completing the fourth water-injection well of a five-spot pilot operation could account for much of this time; however, the operator intends to continue development of the productive acreage on the basis of the pilot waterflood oil recovery.

ACKNOWLEDGMENTS

The writer extends appreciation to the officials and employees of the Barron Kidd Oil Co., Sistersville, W. Va., who made this report possible by furnishing information and statistical data on their operations.

Sincere thanks are extended to Sam Morris, Barron Kidd Oil Co., for his cooperation and assistance with this report and to Marshall Gault, Eureka Pip Line Co., Oil City, Pa., and The Pure Oil Co., Chicago, Ill., for supplying additional production data.

GENERAL GEOLOGY OF WETZEL COUNTY

The subsurface stratigraphy of Wetzel County is shown by a generalized geological column (fig. 3) constructed from drillers' logs of wells drilled i the county.

Alternating beds of sandstone and shale of the Permian period underlie the area. The Permian formations rest on limestone, coal, and shale beds of the Pennsylvanian period. These Pennsylvanian deposits are underlain by sand shales, and limestones of Mississippian age.

The deepest part of the Appalachian basin underlies Wetzel County. From the northeast-southwest trending axis of the synclinorium, the underlying rocks rise to the northwest and southeast and are folded into two anticlines and three synclines. (See fig. 2.)

HISTORY OF OIL AND GAS PRODUCTION IN WETZEL COUNTY

Oil was discovered in the Gordon sand in 1895. Intensive drilling devel oped the area so that Wetzel County is now one of the State's leading oil and gas producing areas. The county covers 220,700 acres and is divided into seven districts: Proctor, Center, Clay, Church, Grant, Green, and Magnolia. Oil and gas have been produced in all districts except Magnolia at depths about 300 to 2,500 feet below the top of the Pittsburgh coal seam.

Oil and gas were first produced in 1899 from the Gordon sand in the Proctor district. In the early 1930's, a Maxton sand gasfield was discovered in the north-central part of the district. A productive section of the Cow Run sand was discovered in 1937 near the village of Proctor, north of New Martinsville. All oil and gas production in the district has been from these three sands in the northern half of the district.

Generated on 2024-09-22 02:45 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The Gordon oilfield in Center district was defined by 1908. During the development period, a gas-producing section of the Gordon stray sand was found east of the oil pool, but no other productive sands have been found.

Oil and gas have been produced within the Clay and Church districts from nearly every known productive bed, including the Fourth sand at about 3,500 feet. The first oil was produced in 1895, and the productive area was defined by 1908. Most of the oil was produced from the Gordon, Maxton, and Fourth sands. From 1914 to 1919, an urgent demand for gas brought about an active drilling campaign that resulted in the production of several million cubic feet of gas daily from the Big Injun and Gordon sands.

Activity in these districts in the past 20 years has been limited essentially to workovers and drilling of 700- to 800-foot gas wells into the Sewickley and Pittsburgh coal seams. However, a well drilled into the Maxton sand near Hundred, W. Va. (Burton oilfield) in 1957 initially produced 25 barrels of oil a day with a bottom-hole pressure of approximately 275 p.s.i. This lends credence to Haught's[5] analysis that the Maxton sand wells have depleted only a small area around each well.

Drilling in Grant district before 1904 resulted in extensive oil and gas production in the Big Injun and Gordon sands at depths to 3,000 feet. In the past 20 years, drilling for gas has continued in the Big Injun, Gordon, and Bayard sands at depths to 3,300 feet. During this period, some wells were also drilled for oil in the Gordon and Big Injun sands. Recently, wells have been drilled for gas to the Pittsburgh and Sewickley coal seams at depths of 400 to 700 feet. Individual well production from these coal seams has averaged about 35,000 cubic feet of gas a day.

In the Green district oil pools were discovered as early as 1900. Most of the oil was obtained from the Big Injun and Gordon sands. Production of gas from the Big Injun sand has continued, but no new pools have been located for 20 years.

No commercial oil or gas production has been found in the Magnolia district.

In 1955, Haught[6] estimated that Wetzel County had a total oil- and gas-producing area of 40,000 acres, of which 15,000 acres remain undeveloped. Oil production from the developed acreage was 37,500,000 barrels, leaving an estimated reserve of 189,840,000 barrels of oil in place.

In 1927 secondary recovery of oil by gas injection was started in Wetzel County in the Gordon sand of Grant district.[7]

5/ Haught, Oscar L., Oil and Gas Report and Map of Marshall, Wetzel, and Tyler Counties, West Virginia: West Virginia Geol. and Econ. Survey Bull. 12, 1955, p. 34.

6/ Work cited in footnote 5, p. 40.

7/ Headlee, Alvah J. W., Summary Secondary Recovery Operations in West Virginia to January 1, 1957: Interstate Oil Compact Commission, 1957, 19 pp.

Generated on 2024-09-22 02:54 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

HISTORY AND RESERVES OF THE BURTON OIL POOL

The Burton oil pool was found accidentally in 1902 when a well was being drilled to the Gordon sand. The hole became crooked while drilling through the Maxton sand. In an attempt to straighten the well bore, the well was shot with nitroglycerin and the rig shut down for the night. The next morning the well flowed at an estimated initial rate of 20 barrels a day. This unexpected production led to rapid development, and by 1906 the oil pool had been defined. The wells have had long productive lives with few abandonments.

This pool covers about 1,000 productive acres. The producing sand lies at an approximate depth of 2,300 feet and has an average pay thickness of 53 feet. The total oil production to 1955 was approximately 1,700,000 barrels.[8/] Tucker[9/] estimated in 1935 that the original stock tank oil in the Burton reservoir was 6,450,000 barrels. By substracting the oil produced to 1955, it was determined that there was an unrecovered reserve of about 4,750,000 barrels of stock tank oil in the reservoir.

DISCUSSION OF SANTEE WATERFLOODING PROJECT

Lease Geology

This property is about 4 miles east of Hundred, W. Va., and comprises seven individual farm leases (fig. 4). The surface has rugged topography, and the maximum difference in elevation is nearly 400 feet. Most of the area is cleared, and the hills are used to pasture livestock.

Structurally, the property lies between the Hundred anticline to the west and the Robinson syncline to the east. The structure map (fig. 5) shows that the top of the Maxton sand dips southeast toward the Robinson syncline.

The isopachous map (fig. 6) shows that the sand thickness is 85 feet over part of the Santee Heirs lease. To the south, on the Snodgrass, Maple, and Leezer leases, the Maxton sand thins to 30 feet.

The seven farms, comprising approximately 675 acres, are believed to be the northern two-thirds of the Burton oilfield. The field has a northeast-southwest trend and is about 2 miles long and 1/2 mile wide. Oil production is concentrated in a narrow strip about 1/4 mile wide, extending generally north and south. The average depth to the top of the Maxton sand is 2,300 feet.

History and Development

The Barron Kidd Oil Co. operates the Santee waterflood project in the Burton pool. (See fig. 4.) This operation encompasses 675 surface acres and

---

8/ Work cited in footnote 5, p. 44.
9/ Tucker, R. C., Unpublished report to Sloan and Zook, Bradford, Pa., 1935.

Generated on 2024-09-22 02:47 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

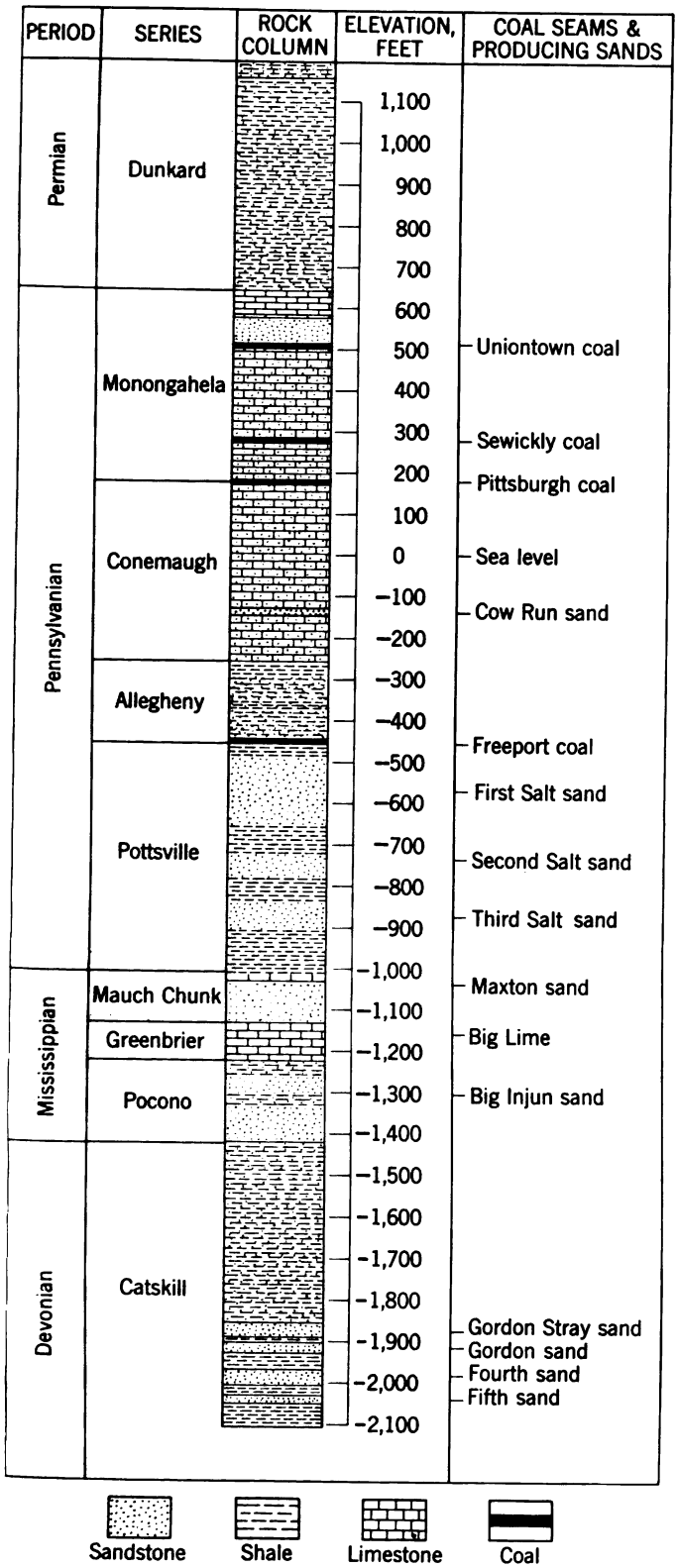

FIGURE 3. - Generalized Geological Column Showing Subsurface Stratigraphy of Wetzel County.

consists of seven leases: Mary Bartrug, L. Lemmons, L. S. Leezer, J. Maple, W. Shough, W. G. Snodgrass, and the Santee Heirs. The discovery well (Santee Heirs well 1) was completed on October 31, 1902, and eight additional wells had been drilled by December 1903. Total oil production for 1902-12 is not known, but the initial oil-production rate of individual wells ranged from 5 to 75 barrels a day. By 1952, 38 oil wells had been drilled on the leases.

In 1953, Santee Heirs well 6 was converted to a gas-injection well with a daily injection rate of 30 M cu. ft. of gas at a well-head pressure of 390 p.s.i. A new producing well (Santee Heirs well 14) was drilled on an offset location. The gas drive and new producing well increased annual oil production from 3,715 barrels in 1952 to 5,362 barrels in 1954.

From January through March 1955, Santee Heirs wells 2 and 6 were converted for water injection, and waterflooding operations were begun in April 1955. By July, Santee Heirs well 4 had been converted for water injection, completing an irregular four-spot pattern with Santee Heirs well 14 as the producing well. This irregular four-spot pattern was used until July 1957, when Santee Heirs well 15 was completed as the fourth water-injection well of a single five-spot pilot waterflood operation. Figure 7 presents a graphic history of oil production from 1913 through 1958.

Drilling and Completion Practices

Standard cable tools with wooden or steel derricks were used

Generated on 2024-09-22 02:45 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

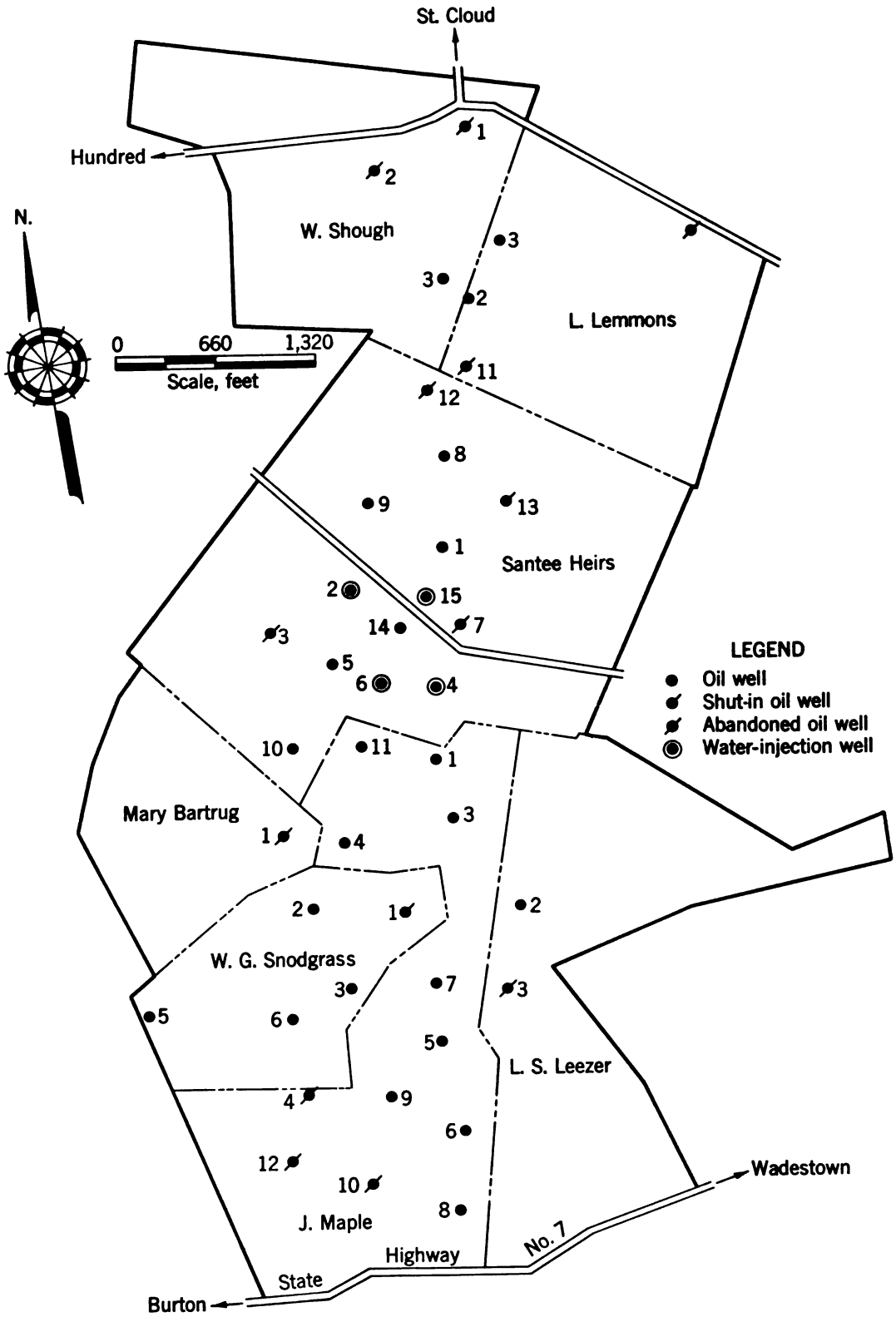

FIGURE 4. - Map Showing Location and Status of Wells and Leases, Barron Kidd Oil Co., Burton Field, Santee Project, Church District, Wetzel County, W. Va., January 1959.

Generated on 2024-09-22 02:48 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

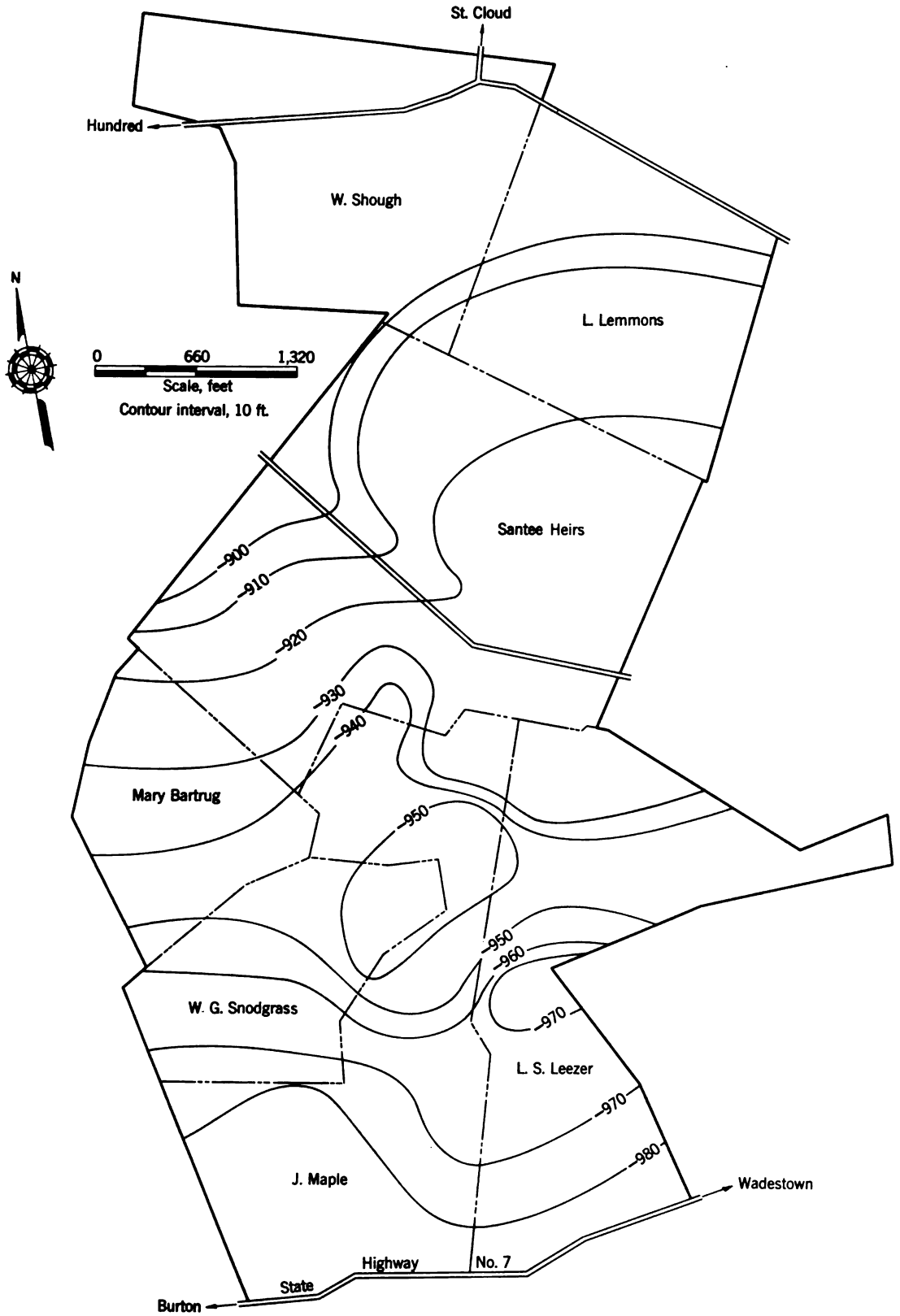

FIGURE 5. - Structure Contour Map Showing Top of Maxton Sand, Barron Kidd Oil Co., Santee Project, Wetzel County, W. Va.

Generated on 2024-09-22 02:52 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

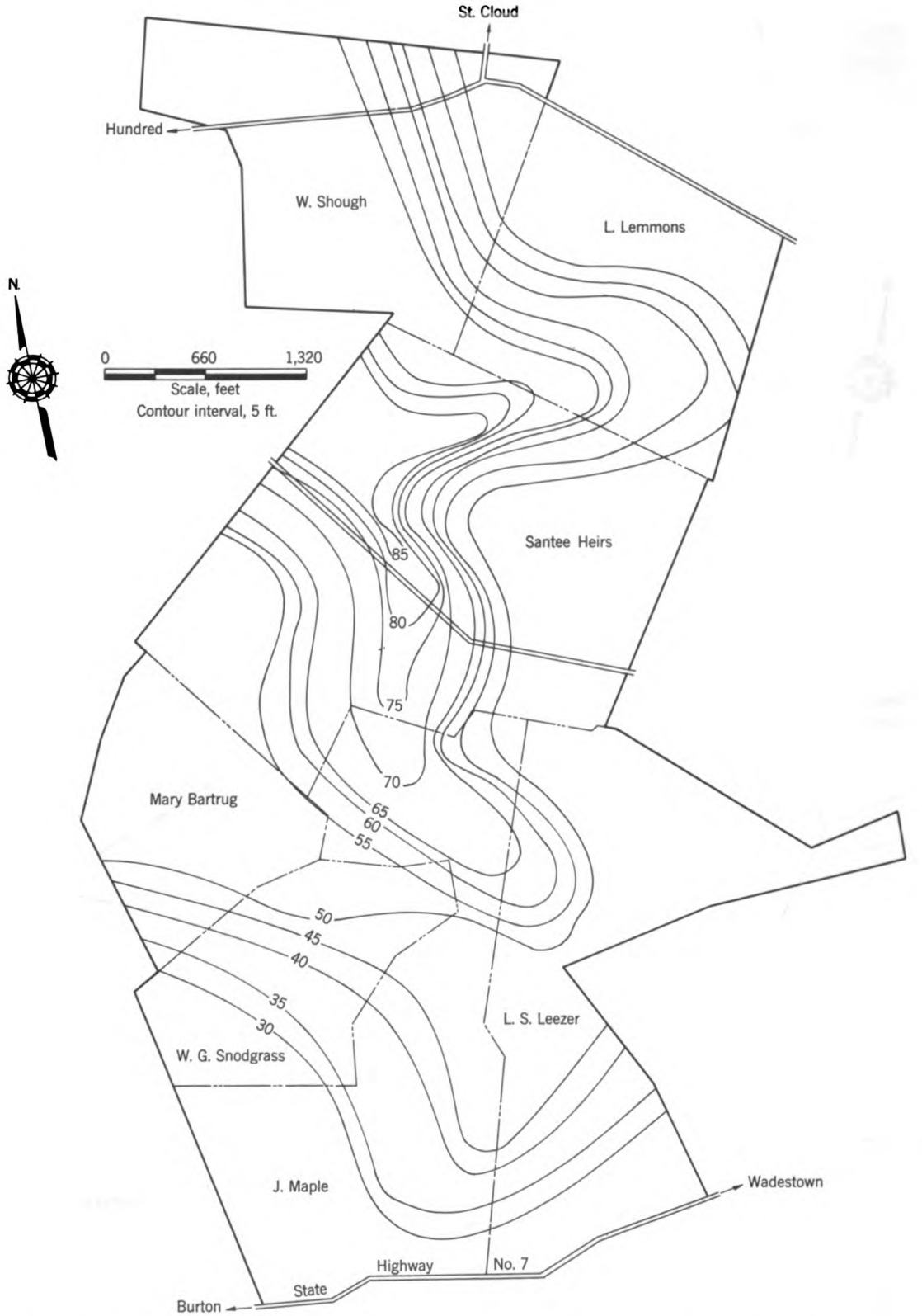

FIGURE 6. - Isopachous Map Showing Thickness of Maxton Sand, Barron Kidd Oil Co., Santee Project, Wetzel County, W. Va.

Generated on 2024-09-22 02:47 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

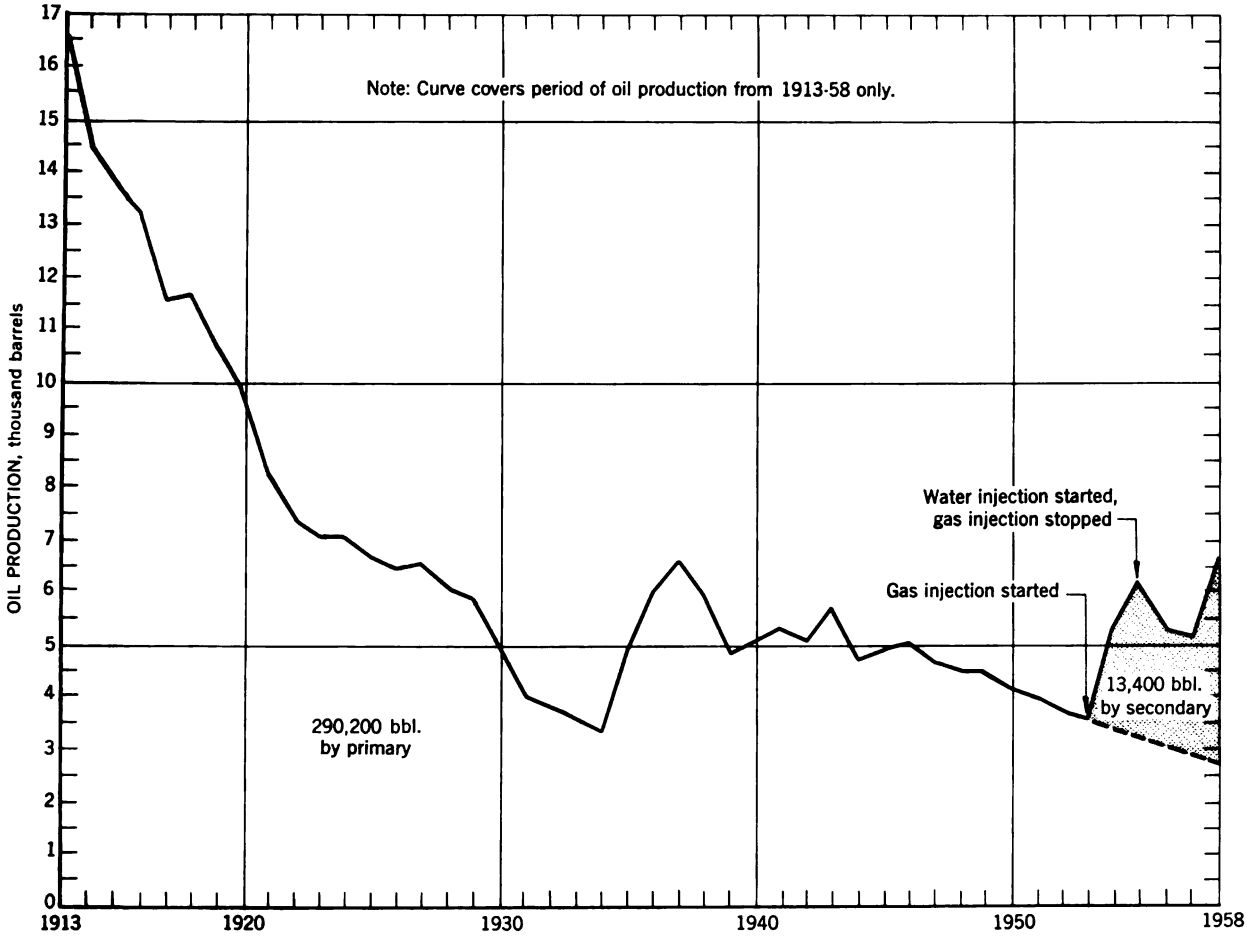

FIGURE 7. - Graphic-Line Production History of Barron Kidd Oil Co., Santee Project, Wetzel County, W. Va., January 1959.

to drill all wells in the project. Drilling time for the early development wells was about 2-1/2 months of daylight work, and the average drilling cost was $1.50 per foot. The only logs for wells drilled before 1954 were kept by the drillers.

With the start of waterflooding operations in 1954, various logs, such as radioactive, caliper, gamma-ray, and isoflow, were run in the new producing, injection, and converted wells.

From 1902 to 1906, when the oilfield was being developed, the usual completion practice was to use three strings of casing: 10-5/8 inches to about 200 feet, 8-5/8 inches to 1,300-1,500 feet, and 6-5/8 inches to 2,000-2,300 feet. Usually, the 10-5/8- and 8-5/8-inch casing was pulled upon completion.

Most of the wells completed in the early life of the field were shot with 1 to 2 quarts of nitroglycerin per foot of pay sand. A string of 2-inch tubing was run to a point near the bottom of the formation, and the working barrel was lowered to the top of the sand. Pumping was done by wire line and a sinker bar attached to a bottom-hole pump in the working barrel. The wooden or steel

Generated on 2024-09-22 02:45 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

derricks and band wheels used during drilling were retained as part of the surface pumping equipment. This equipment, supplemented by a gas engine and walking beam, provided the pumping action. Workovers and cleanout jobs were required on all wells at intervals of 10 to 15 years because paraffin sealed off the producing sand face.

The completion practices for production wells are still virtually the same except that automatic electric pumping jacks are used in place of production derricks. The working barrels are placed near the bottom of the sand.

One new injection well (Santee Heirs 15) was drilled following the procedures used in drilling producing wells. However, a tamp shot of 70 quarts of liquid nitroglycerin was used rather than the customary open-hole shot. The injection string of 5-1/2-inch casing was set on an upside-down packer at a depth of 30 feet in the Maxton sand and cemented to the surface.

Drilling time for a present-day development or injection well is fourteen to fifteen 24-hour days at an average drilling cost of $4.50 per foot.

Producing-Sand Characteristics

The Burton oilfield sand is a hard, fine- to medium-grained, light-colored sandstone that is well sorted and appears to have horizontal bedding planes. It is well cemented and, from visual observation, appears to be limy; however, acid tests prove that there is little solubility of the cementing material.

Commercial core analyses were made on sand samples taken from Santee Heirs wells 14 and 15, and figure 8 shows the results of laboratory tests. The wells were cored with cable tools, and water-base mud was used as the drilling fluid. Core-report averages indicate the following physical properties: Porosity, 11.5 percent; permeability, 42.5 md.; residual oil saturation, 22.8 percent of pore space; and water saturation, 19.7 percent. The crude oil gravity is 43.5° API, and the viscosity is 7.3 centipoises at 86° F. which is the assumed reservoir temperature.

Source and Treatment of Water

The fresh water used for flooding on this project is supplied by two shallow wells (not shown in fig. 4) and a large surface pond. The water is produced from a limestone aquifer at a depth of about 100 feet. By means of a manifold, water from the two sources is mixed and chemically treated with 1 pint of premixed solution of caustic soda and sodium hypochlorite to each 2,000 barrels of water. The treated water is pumped to a 210-barrel settling tank where the products from the chemical reactions are precipitated. Water from the settling tank flows through an anthracite-filled pressure filter and into a 210-barrel, clear-water storage tank. A tank installed at a higher elevation than the filter furnishes a high rate of backwash water. The single-filter system is backwashed every day during the dry summer months and about once a week the remainder of the year. The treated water enters the water plant and is pumped to the injection wells at a pressure of approximately

Generated on 2024-09-22 02:47 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

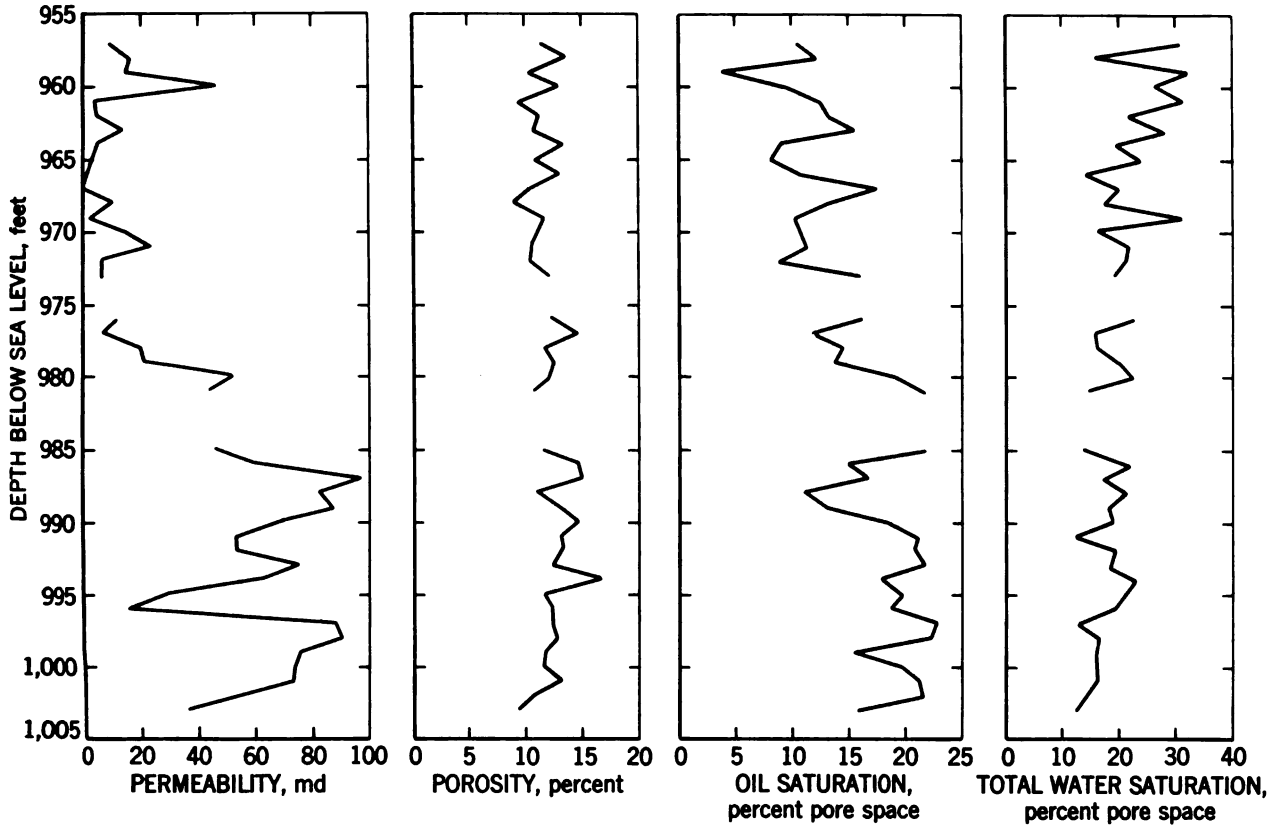

FIGURE 8. - Results of Core Analysis, Santee Heirs Well 14, Barron Kidd Oil Co., Santee Project, Wetzel County, W. Va.

1,600 p.s.i. by a skid-mounted, 25-hp., electric-motor-driven 2-1/4- by 5-inch Aldrich triplex pump.

Summary of Operations

Table 1 summarizes annual oil production from 1913 through 1958 and gives volumes of water injected and oil produced each month from April 1955 through December 1958; pertinent data on the waterflood are also included.

Generated on 2024-09-22 02:48 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 1. - Summary of operations

Location: Wetzel County, W. Va.
Sand flooded: Maxton
Depth to top of sand: 2,300 feet
Average sand thickness: 53 feet
Total acreage involved: 675 acres
Productive acreage: 220 acres
Well pattern: 5-spot

Type of water: Fresh
Type of system: Open
First gas injection: 1953
First oil increase by gas injection: 1954
First water injection: 1955
First oil increase by water injection: 1958

Record of oil production

Year	Barrels	Year	Barrels	Year	Barrels
1913[1].....	16,464	1929.....	5,859	1944.....	4,655
1914.....	14,579	1930.....	4,871	1945.....	4,868
1915.....	13,833	1931.....	4,026	1946.....	4,998
1916.....	13,190	1932.....	3,802	1947.....	4,653
1917.....	11,574	1933.....	3,568	1948.....	4,501
1918.....	11,690	1934.....	3,313	1949.....	4,401
1919.....	10,651	1935.....	4,841	1950.....	4,116
1920.....	9,865	1936.....	5,960	1951.....	3,909
1921.....	8,246	1937.....	6,588	1952.....	3,715
1922.....	7,440	1938.....	5,936	1953[2].....	3,506
1923.....	7,074	1939.....	4,771	1954.....	5,362
1924.....	7,036	1940.....	5,033	1955[3].....	6,150
1925.....	6,697	1941.....	5,259	1956.....	5,231
1926.....	6,426	1942.....	5,032	1957.....	5,053
1927.....	6,506	1943.....	5,650	1958.....	6,633
1928.....	6,105				

Monthly record of pilot waterflood operation--water injected and oil produced, bbl.

Month	1955		1956		1957		1958	
	Water injected	Oil produced	Water injected	Oil produced	Water injected	Oil produced	Water injected	Oil produced
January.....		431	5,934	269	5,191	282	5,983	286
February.....		393	5,501	243	4,860	222	5,419	245
March.....		384	5,730	255	5,310	235	5,742	274
April.....	[4]3,440	369	5,411	264	5,334	302	5,477	362
May.....	4,711	326	5,533	332	5,271	248	5,718	290
June.....	2,566	380	5,317	261	5,151	233	5,421	348
July.....	[5]3,367	287	5,274	298	[6]5,723	323	5,010	432
August.....	3,309	409	5,059	271	6,216	236	4,828	381
September.....	5,100	309	5,228	277	6,039	238	4,849	548
October.....	5,628	278	5,048	301	5,569	299	7,455	425
November.....	6,273	352	4,829	215	5,526	237	6,771	445
December.....	6,071	258	4,692	217	6,053	217	6,440	592
Total.....	40,465	4,176	63,556	3,203	66,243	3,072	69,113	4,628

[1] Prior production not available.
[2] Gas injection started.
[3] Gas injection discontinued, water injection started.
[4] 2 water-injection wells in operation.
[5] 3 water-injection wells in operation.
[6] 4 water-injection wells in operation.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1961 O - 581512

Generated on 2024-09-22 02:52 GMT / https://hdl.handle.net/2027/osu.32435030643324
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY